THE RELATION OF ILLUMINATING GAS TO PUBLIC HEALTH.

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In 1792, one William Murdoch, in his little house in Cornwall, for the first time in the history of man, lighted a house with illuminating gas. Shortly after that some of the manufacturing establishments of Manchester, and notably the great engineering establishment of Boulton and Watt (he of the steam engine) were likewise lighted by illuminating gas—a gas made by the destructive distillation of bituminous coal, for distribution through these shops in pipes. Lighting with gas, however, did not grow very rapidly in popular favor. In 1810 it was introduced into some parts of London, in 1820 into some parts of Paris, in 1821 into Baltimore, in 1822 into Boston, and in 1823 into New York; and yet so slowly did this new practice develop that Dr. John Collins Warren, in speaking the other evening about the introduction of illuminating gas into Boston, said that his father, when he went to occupy a new house on Park street, occupied the first house in Boston to be lighted by illuminating gas—and that was in 1845. So that this introduction of gas in 1822 must have been into the streets, public buildings and the like. By 1855, however, virtually all of the cities of Massachusetts had illuminating gas distributed. During the Civil War the distinguished and beloved founder of the Institute of Technology, Professor William Barton Rogers, afterward President Rogers, was appointed by the war governor, John A. Andrew, as the first state inspector of gas meters and gas in the United States, and the first, of course, in Massachusetts.

In those days there was no idea that there was any connection between illuminating gas and public health. President Eliot's father published an important paper in 1855 on illuminating gas, and said nothing, or next to nothing, about its relation to public health, and, as I have intimated, no gas inspector was deemed necessary until during the period of the Civil War, and then not mainly on sanitary grounds. The use of gas, however, grew apace, and it was produced by the same process of manufacture until about 1870, when a new process was invented by a Frenchman, perfected by an American and patented by the latter, I think, in 1874. It was a process of making illuminating gas not by the destructive distillation of bituminous coal, but by passing steam over incandescent coal or carbon of some

sort, under which conditions the steam or water was decomposed, so that hydrogen and carbon monoxide and some carbonic acid and traces of other gases came off at the top of the retort, the gas being non-luminous, but called, because it was made from steam in this way, water gas. It became necessary, of course, to enrich it for illuminating purposes, and it is still so made and so enriched by oils or naphthas, and is the gas which we are today using in whole or in part in most of our cities.

By 1880 it had become a rather common practice to make water gas, and a corporation desiring to compete with the old Boston Gas Company and the other gas companies of this state held the water gas club over the owners of the old gas companies and their stock, telling them to surrender at a low price or they would manufacture water gas and put them out of business. The owners of the old gas companies, however, were unwilling to hold up their hands and surrender without a fight. They accordingly employed the sanitary club which has been so often used, rightly or wrongly, in public and political affairs, and secured the passage of a law providing that no illuminating gas containing more than 10 per cent. of carbon monoxide should be manufactured and distributed in this state. It was believed that the new gas was very poisonous, and it was comparatively easy for the old gas companies, with all their influence, to get the law passed, and the plans of the invading corporation were temporarily checked.

A battle royal was then fought by the owners of the water gas patents, who hated to see their favorite gas put under a ban or prejudiced in any way in popular favor, either in this state or elsewhere, and who were fearful that a prohibitive law might be put in force in other states, as well as in Massachusetts; although, as a matter of fact, there was little danger of that. In 1884 one of the largest arrays of legal talent ever gathered was seen in the state house, with Mr. Richard Olney at the head of the old gas companies and Mr. Robert M. Morse at the head of the water gas interests. The State Board of Health, Lunacy, and Charity, as it was then called, was drawn into the controversy, and in 1883 requested my distinguished and lamented colleague, Prof. William Ripley Nichols, to take up an investigation of the sanitary qualities of the new gas and compare them with those of the old. I had just come to Boston at that time from the Johns Hopkins University, and Professor Nichols invited me to join him in this work.

We set to work very carefully, Professor Nichols doing the chemical work and I doing the physiological experimentation upon animals. We made an elaborate series of investigations, partly in a barn which I had modified for the purpose, in Newton Centre, where I then lived, partly in Athol, which was illegally using the new gas, and partly in Middletown,

Connecticut, where Professor William O. Atwater, the distinguished food expert, an old friend of mine, kindly gave me the opportunity to experiment. In 1884 the results of our experiments were published, and they bore heavily against the new gas. The results, briefly, were these: If in a room of 800 cubic feet—a small hotel bedroom—the gas should be let on during the night from one or more burners, the chances were good that if the gas were the old-fashioned gas—the coal gas, so-called, whoever was in that room would be taken out in the morning with a bad headache and feeling very dull and stupid, but still alive; whereas, if the gas were water gas, he would almost surely be taken out dead. This report was based on the results of our experiments upon animals, and we made enough experiments to be sure of our ground. We further predicted that if the law should be repealed, and water gas introduced into this state, the deaths from gas poisoning would increase enormously.

The sanitary club which our report constituted enabled the old gas companies to hold off the water gas company until they received their price. Then the sanitary club was laid on the shelf and forgotten, and all hands, old and new, united in the repeal of the old law because it interfered with business. In 1890 the law was repealed, with what results we propose to show you this afternoon.

One of the by-products of this agitation, and a good by-product, was the formation of a commission, known as the Gas Commission, afterwards changed to the Gas and Electric Light Commission. One of the good, sanitary things which they were required to do was to keep track of the injuries from gas poisoning and to report them annually. That they have done from that day to this. When the medical examiner system came into vogue we had a body of trained medical men who investigated deaths from gas poisoning, and investigated them intelligently. We have two sets of reports, therefore, upon which we can base our statistical studies—the medical examiners' returns, and the returns of the Gas and Electric Light Commissioners. Mr. Schneider and I have found those of the medical examiners somewhat more dependable and have chiefly used their reports.

It was twenty-three years ago when this commission was appointed, and we began to get our statistics, and twenty-four or twenty-five years ago since I became interested—intensely interested—in the subject. I have spoken to this Association more than once upon this subject, but after the lapse of twenty-five years it seemed to me well to go back and see what Professor Nichols and I said, and how the facts have borne out our predictions. On looking over the results I feel in some respects very well contented. But apart from those considerations, Mr. Schneider and I were surprised, shocked, and astounded, by the extent to which illuminating

gas poisoning is going on in this state and in other states, for it is not merely, or even chiefly, in this state.

In Rhode Island, in New York, in Pennsylvania, and elsewhere, but especially in the northern tier of states, gas poisoning is today a very serious cause of sickness and death; how serious may be judged by the following facts: The rate per 100,000 in gas poisoning in this state and in Rhode Island is now quite comparable with that of scarlet fever in some years, and measles, in others. For example, in 1905, in Massachusetts, the rate for measles was 5.9 and for scarlet fever 3.9, both of which figures are exceeded by some of the figures for gas poisoning. In 1909 the rate for measles in Massachusetts was 4.76 and that for scarlet fever 7.86, figures again either exceeded or approached by the statistics of deaths from gas poisoning. As for infantile paralysis, about which we hear so much, gas poisoning is a far more serious cause of death today than that is, and ought to be taken account of correspondingly. It is not so alarming, because we know more about it. We are always alarmed by the things that we don't understand; we are apt to be too little alarmed by the things with which we have become familiar. Let us compare gas poisoning with a disease like typhoid fever. Typhoid fever in Cincinnati this last year reached the rate of only 5 per 100,000. In Hamburg, Germany, it has been 4 and 5 per 100,000 for some time. In other words, more people are dying of illuminating gas in Rhode Island and Massachusetts than are dying of typhoid in Hamburg, and in many other places.

Our figures begin with 1886, because previous to that time no adequate records were kept. In 1885, Dr. S. W. Abbott, speaking upon the relation of illuminating gas to public health, said that there were more deaths from illuminating gas poisoning in the first year after the law was repealed than there had been in the previous fifty years in the state of Massachusetts.

Mr. Schneider has very carefully worked out from the reports of the Gas Commissioners, the total amounts of gas made in the state. It must be remembered that there are many people in the state who get no gas. There are some companies which chiefly make water gas, and some which chiefly make coal gas, but most of them today mix the two, the water gas being quicker to make and in many ways a great help to the gas manufacturer. The actual cost of coal gas and water gas today is said to be just about the same; sometimes one is a little more expensive, sometimes the other.

The deaths from gas increased very quickly after the repeal of the law in 1890, reached a high maximum in 1898, fell off very suddenly to 1901, and ran up again to its very high position in 1908. In 1901 the New England

Gas & Coke Company, a coal gas corporation, was established in Everett, and began introducing vast quantities of coal gas into the total output, so that the water gas made in that year fell off.

During the year 1901, while the number of suicides from all methods rose, deaths from gas poisoning were very low.

Another very interesting point is the seasonal distribution of gas poisoning. Of course, less gas is used in summer than in winter. The days are long, the nights are short, the windows are wide open. Suicide is less frequent in the summer. The high points of suicide, as we should see if we had the seasonal curve, are in April and October, and in summer the whole number of deaths is small.

This total number of deaths by gas poisoning is divided into accidental and suicidal, as indicated by the medical examiners. Accidental and suicidal deaths run about half and half, according to their returns. It is often a fine point to determine whether a case is accidental or suicidal.

This matter of suicide by gas is very important, and not to be passed over lightly. We make it difficult for people to get morphine and certain other poisons, but we make it very easy for them to get illuminating gas, and then fill the newspapers with accounts of gas poisoning, suicidal and otherwise, which influence the mentally unbalanced. Thus it is a fact that gas has become a very popular suicidal agent—how popular, you will see when you realize that about one-half of the high death rate from gas poisoning is suicidal. Accidents reach their highest point in December, because the days are short, the nights long, the windows closed—the gas is used early and perhaps blown out or left to go out early. All things thus conspire to make the cases of accidental gas poisoning numerous at that time; but gas is not so much used for suicide then as later.

It is possible to have deaths from gas poisoning with no gas pipes in the house. A house in winter, as you know, acts as a chimney, the heated air rising and sucking in the ground air. Those cases are common and well known to students of this subject.

From newspaper clippings, we can cite various ways by which gas poisoning has occurred. Sometimes an animal like a rat or a cat, running by a cock on a gas stove, will open it, as is stated in one of these cases. Sometimes people will blow out the gas. But the quarter-in-the-slot meter is today responsible for a large number of deaths. In a recent case, robbers broke a slot meter to get the money, whereupon gas was let into a house, and a large number of people had their lives jeopardized, and some were killed.

It is fair to say that in the fifty years preceding the repeal of the law regulating the amount of carbon monoxide in gas, there were not half a

dozen cases of gas poisoning outside the two or three where the gas was being used in Massachusetts in violation of the law. Since that time it is safe to say that there have been at least 1200. Is not that a pretty high price to pay for the convenience of manufacturers?

The remedy is the return to the use of the old-fashioned coal gas, which is still used in many places, and which by the testimony of gas men is not much, if any, dearer than the water gas, but which is much less convenient to make. It is argued by the gas men that the water gas has a higher candle power. So it has, nominally, according to the common methods of measurement, but all I can say on that head is this: I would like to go back to the old coal gas simply and purely on candle power. The old light was a better light than the light today. Although the light today may read 24 candles and the old one read only 16, I know that the old gas was a better gas for domestic use, and I would rather pay $1.50 a thousand, which I used to pay for the old coal gas, simply from the lighting point of view, and without any connection whatever with sanitary ideas, than to pay what I do now for the so-called 24-candle water gas.

Massachusetts is entitled to credit for having required a record of cases of gas poisoning. She is not entitled to great credit for having repealed the ten per cent. law. Gas has become in Massachusetts, and especially in Rhode Island, a very important cause of death, and it is our business as sanitarians to take cognizance of that fact and as opportunity offers to act upon it.

The complete papers of the authors with diagrams and statistics will be published—probably in the *Journal of Infectious Diseases*—in the near future.